Liquidity and price discovery in real estate assets

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Citation for published version (APA):

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Chapter 1

Introduction

Buying or selling a house is for most households the largest financial transaction they will make in their lives. A house is an illiquid and indivisible asset and its value comprises a substantial part of the household balance sheet. The selling process is characterized by a high level of uncertainty, not only about the final transaction price, but also about the length of time it will take to sell the house, if the house will sell at all. The selling process is further complicated by asymmetric information between the seller and potential buyers about the true quality of the house. Sellers have an incentive to claim their house is of high quality but potential buyers will be wary of the possibility of hidden flaws in the house. Heterogeneity between the set of characteristics of for-sale houses will make potential buyers spend a substantial amount of time on the market before they find a house that best matches their preferences.

This dissertation covers three empirical essays on the housing market. Although we limit ourselves here to the housing market, the findings might be relevant for other sectors of the real estate market or any other market that is characterized by illiquidity, indivisibility of goods and a high level of heterogeneity between goods. Chapter 2 tests two hypotheses bases on empirical predictions from theoretical literature on the selling process in the housing market. We first test whether the empirical predictions from Taylor (1999) - the probability that a house will sell will decline with the time the house has already spent on the market, and the probability that a house will be withdrawn from the market will increase with the time the house has already spent on the market - are true. We also test whether there is a sharp drop in the probability of a sale after the house has spent a sufficient length of time on the market for the current stock of potential buyers to have evaluated the house, as predicted by

1In the Netherlands the value of housing comprises 54% of household equity (Van Ewijk and Ter Rele, 2008).
the stock-flow matching model in Coles and Smith (1998). Chapter 3 considers the role of the list price in the housing market. List prices do not have a formal role in the Dutch housing market and many other housing markets. The list price does not act as a ceiling on the transaction price and transaction prices above the list price are observed frequently. List prices would have no role in a housing market with symmetric information between sellers and buyers and the probability of a sale would not be affected by reductions in the list price. Based on this observation we test for the presence of asymmetric information between sellers and buyers in the housing market by testing whether reductions in the list price affect the probability of a sale. Chapter 4 investigates the well know price-volume correlation in the housing market. We estimate a Vector Error Correction Model on a rich set of variables. Apart from a transaction price index and sales volume data, our data includes a list price index and the flow of houses entering the market. We compare our empirical results against the empirical predictions from a number of housing market theories.

1.1 Sales Versus Withdrawals from the Market

Houses typically spend a long time on the market before they are sold. In our dataset from the NVM (Dutch Association of Real Estate Brokers and Real Estate Experts), the average time till sale between 1985 and 2007 was 87 days. Some houses do not sell but are withdrawn from the market before a sale took place. The average time till withdrawal for houses in our dataset that were withdrawn from the market before being sold was 200 days. Of particular interest is whether potential buyers view houses which have spend a long time on the market differently from similar houses which have spend a short time on the market. Taylor (1999) develops a model where potential buyers view time on the market as a signal of inferior quality of the house. The implication is that potential buyers’ mean valuation of the house declines with the length of time the house has spent on the market. Furthermore, the probability that the house will sell also declines with time on the market. Houses that fail to sell after spending a long time on the market can be withdrawn from the market as the seller prefers to retain the utility the house currently brings him over accepting a bid below his reservation price.

Negative duration dependence in the hazard rate of sale (i.e. the speed of sale) of for-sale houses has been found by e.g. Huang and Palmquist (2001), Pryce and Gibb (2006) and Zuehlke (1987). This negative duration dependence implies that the probability that a for-sale house will be sold declines with time on the market. The current empirical literature on time on the market has not investigated whether there is duration dependence in the hazard rate of withdrawal (i.e. the speed of withdrawal). In chapter 2 we fill this gap in the literature by investigating both time-till sale and time-till withdrawal simultaneously in a competing risks duration model with unobserved heterogeneity with dependence between the hazard rate of sale and the hazard rate of withdrawal. We use the most flexible specification for the duration dependence structure used to date in the time on the market literature. We use a
piece-wise constant specification for both the duration dependence in the hazard rate of sale and the hazard rate of withdrawal. This flexible specification enables us to test whether the hazard rates are monotonically increasing or decreasing with time on the market. A monotonically decreasing hazard rate of sale and a monotonically increasing hazard rate of withdrawal would be consistent with the theory in Taylor (1999). Furthermore, we interact the duration dependence term with the calendar time effect as Pryce and Gibb (2006) have shown that the duration dependence structure is not constant over long sample horizons.

The stock-flow matching model from Coles and Smith (1998) also yields empirical predictions for the probability that a for-sale house will be sold. In the model in Coles and Smith (1998), potential buyers spend a significant time on the market searching for a house that best matches their preferences and a for-sale house is first evaluated by the current stock of potential buyers on the market. After the current stock of potential buyers has rejected to buy the house, the house will only be considered by the new flow of potential buyers entering the market. This implies that there should be a sharp drop in the probability of a sale after the current stock of potential buyers has rejected the house since the flow of potential buyers entering the market is only small compared to the current stock of potential buyers on the market. We test this empirical prediction with our duration model by investigating whether the duration dependence terms for the hazard of sale are constant for the first short time on the market period followed by a sharp drop in the value of the duration dependence terms after the initial short time on the market.

1.2 The Role of the List Price

Advertisements of for-sale houses are often accompanied by lots of information about the house being offered for sale. Often pictures of the interior and exterior of the house are included in the advertisement as well as a detailed description of the characteristics of the house and the location and a list price. List prices do not have a formal role in the Netherlands and many other housing markets. The list price does not act as a ceiling to the transaction price and houses can be sold at prices above the list price. A key question therefore is what the role of the list price is in the housing market. The list price might reflect characteristics of the house or the seller which are unobservable to potential buyers. Such characteristics might for example be how motivated (or impatient) the seller is to sell the house. If the housing market would be characterized by symmetric information between buyers and sellers (as in Olsen (1969)) there would be no role for list prices. In such instance both the seller and potential buyers would possess the same information set and a list price would be obsolete. A good test for asymmetric information in the housing market would therefore be to test whether list prices affect outcomes (e.g. time till sale or transaction price) in the housing market. We formulate such a test in chapter 3. We focus on the change in the list price rather than the level of the list price since the level of the list price might be affected by factors which are unobservable to the econometrician.
Our dataset from the NVM includes list price revisions for the years 2005 - 2007. About 20% of sellers lower their list price for their for-sale house during this period and the average list price reduction is 5.5%. We use a timing-of-events duration model as described in Abbring and Van den Berg (2003), where we specify the event to be a list price reduction. We extend the model by allowing for competing risks, where the competing risks are a sale of the house or a withdrawal of the house. We allow for unobserved heterogeneity and dependence between the hazard rate of sale, the hazard rate of withdrawal, and the hazard rate of repricing. Our test for asymmetric information in the housing market consists of testing whether a list price reduction affects the hazard rate of sale and possibly the hazard rate of withdrawal.

Lazear (1986) provides a two-period model in which list prices are actually important. Sellers face uncertainty about buyers’ valuations, and learn in the first period. Therefore, second-period list prices are lower than in the first period. The empirical prediction from the model is that list prices decline with time on the market. That is, the longer a house remains on the market, the higher the probability that the list price will be reduced. We test the empirical prediction by testing for positive duration dependence in the hazard of repricing in our timing-of-events duration model.

### 1.3 The Price-Volume Correlation

Several studies find a positive correlation between price and volume (houses sold) in the owner-occupied housing market. The pattern is found in the US housing market but also in the UK and Sweden. Although this general pattern is confirmed by most studies, the empirical picture is not without ambiguity. For example, Miller and Sklarz (1986) find that the rate of sale in one quarter is positively related to the price change in the next quarter based on condominium data from Hawaii. Stein (1995) on the other hand finds, based on aggregate US data, a significant relation between current sales volume and last year’s rate of price change, i.e. a temporal lag in the opposite direction to that found by Miller and Sklarz.

Other papers analyze dynamic econometric models with more structure. Hort (2000) finds no consistent correlation between price changes and turnover changes using panel data for local housing markets in Sweden. Hort goes on to investigate how shocks to fundamentals are transmitted into house prices and sales. Based on a VAR-model she concludes that an interest shock has an immediate negative impact on sales but affects prices only gradually. Andrew and Meen (2003) study aggregate UK data focusing on the adjustment to fundamentals. They find that a shock to fundamentals impact sales and prices in the same direction.

Broadly speaking one can identify three groups of theories to account for the price-volume correlation found in the housing market. The first theory can be described as the credit constraint theory. In the credit constraint theory a favorable shock
to housing market fundamentals, such as mortgage rates and unemployment, gives rise to an increase in prices. This appreciation in prices increases homeowners’ equity, thereby releasing downpayment constraints. This will have a positive impact on mobility which results in increased transaction volume. This increased transaction volume reflects an improvement in liquidity and this will cause prices to rise even further. Credit constraint theories are described in Stein (1995) and Ortalo-Magné and Rady (1999, 2006). Another set of explanations focuses on the housing market as a search market that fails to clear instantaneously. In the model of Berkovec and Goodman (1996) sellers and buyers are assumed to observe transaction prices but otherwise to be uninformed about underlying market conditions. As a result, a demand increase leads to an immediate increase in transaction volume followed by a gradual increase in reservation and transaction prices. Another explanation from the search market theory for the price-volume correlation has to do with market liquidity. A correlation between price and volume may reflect variations in liquidity and the quality of matching between buyers and sellers. Many sales and more houses on the market should be associated with higher liquidity in the sense of a shorter time to sale and less price uncertainty. This connection has been analyzed by Krainer (2001) and Novy-Marx (2009) in a search market context. A third explanation for the price-volume correlation derives from behavioral considerations. Genesove and Mayer (2001) and Engelhardt (2003) represent seller behavior by prospect theory implying that the marginal disutility of losses exceeds the marginal utility of gains. This phenomenon has been described as loss aversion. If this is the case, sellers should be reluctant to set an asking price below their original purchase price. Genesove and Mayer (2001) and Engelhardt (2003) find empirical support for this hypothesis.

In chapter 4 we document the price-volume correlation for the Dutch housing market. Furthermore, we try to identify the mechanism giving rise to the price-volume correlation using a Vector Error Correction Model. We have variables measuring fundamental developments such as the 5-year fixed mortgage rate and the unemployment level. With respect to market variables, we do not only have transaction price data and sales price data (as other studies do), but we also have list price data and the number of houses put up for sale per month. We compare our results to the credit constraint, search market, and behavioral explanations for the price-volume correlation and establish which of the three theories is consistent with our empirical findings.